Satellites that come to paſs conformable to the calculus of *Caſſini*, and differ days and hours from the calculus and predictions made upon the hypotheſes of *Galilæi*: Beſides that there ſhould happen a great many which do not happen according to the ſyſtem of *Caſſini*. *E.g.* according to the hypotheſis of *Galilæi*, the fourth of the Satellites ſhould have more than 90 Eclipſes in a year, of the duration of three or four hours; but according to the ſyſtem of *Caſſini*, the ſame Satellit will be three or four years without ſuffering any Eclipſe. Which proceeds from nothing but the falſe ſcituation of the Orbs ſuppoſed by *Galilæi*; as the great difference of the time of the Eclipſes that happen depends from this, that neither *Galilæo* nor the other Aſtronomers do ſeparate from the proper motion of the Satellites the appearances which do befal it by that of *Jupiter* about the Sun. And therefore 'tis, that they have taken for a ſimple and equal motion a motion compounded of an equal and unequal; whence they have ſlipped into an error about the Mean motions, which in progreſs of time hath ſo increaſed, that the Configurations drawn from their hypotheſes for that time have almoſt no likeneſs at all with thoſe that are obſerved.

Theſe old hypotheſes were therefore far off from ſerving to find the Longitudes, as their Authors intended them; ſince it was impoſſible for them not only to obſerve the Eclipſes of the Satellites for ſome years to the nearneſs of an hour, but even to make us know and diſtinguiſh at this time one Satellit from another, whereas by the Syſtem of Signor *Caſſini* one may predict for many years to come the Eclipſes of the Satellites with as much preciſeneſs, as thoſe of the Sun and Moon by the Aſtronomical Tables.

Methodus directa & Geometrica, cujus ope inveſtigantur Aphelia, Eccentricitates, Proportioneſque orbium Planetarum primariorum, abſque ſuppoſita æqualitate anguli motûs, ad alterum Ellipſeos focum, ab Aſtronomis hactenus uſurpatâ. Auth. *Edmundo Hally* Jun. è Collegio Reginæ *Oxon.*

M*Otus Terræ annuus per Eclipticam, opticam inæqualitatem inducit motibus cæterorum planetarum, Aſtronomis* Copernicanis *nomine Parallaxeos orbis notiſſimam; quam quidem inæqualitatem, ex obſervationibus non multâ operâ datam, methodi ſequentis baſin firmiſſimam conſtituo; ubi præter obſervata nihil aliud ſupponitur, quàm quòd orbes Planetarum ſint Ellipſes, quódque Sol in foco, omnium orbibus communi, ſit conſtitutus, & denique, quòd tempora periodica*

ſingulorum

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ſingulorum ita innoteſcant , ut non ſentiatur error aliquis, ſaltem in duabus vel tribus revolutionibus: His conceſſis, motus Terræ, pro cæteris Planetis neceſſariò requiſitus, primò aggrediendus eſt.

Tab.I. Fig.2. *Sit* S *Sol*; ABCDE, *orbis Terræ*; P, *Planeta* ♂ *Mars*, (*qui in hanc rem plurimis de cauſis longè præferendus eſt*;) *& primò obſervetur verum tempus & locus, quo* ♂ *Mars opponitur Soli; tunc enim Sol & Terra coincidunt in lineam rectam cum Marte; vel, (quod fere ſemper accidit) ſi habuerit latitudinem, cum puncto, ubi perpendicularis à Marte demiſſa in planum* Eclipticæ *incidit. Sic in* Schemate, S, A, *&* P *ſunt in linea recta; deinde poſt* 687 *dies, Mars revertitur ad idem punctum* P, *ubi in priori obſervatione Soli opponebatur; Terra verò, cùm non revertatur ad* A, *niſi poſt* $730\frac{1}{2}$ *dies, in* B, *Solem reſpicit in linea* SB, *Martem verò in linea* BP, *& obſervatis longitudinibus Solis & Martis, omnes anguli Trianguli* PBS *dantur, & ſuppoſitâ* PS 100000, *in iiſdem partibus invenitur longitudo lineæ* SB; *pari ratione poſt alteram Martis periodum, Terra exiſtente in* C *invenitur linea* SC, *nec abſimiliter lineæ* SD, SE, SF; *differentiæque obſervatorum locorum Solis, ſunt anguli ad Solem* ASB, BSC, CSD, DSE: *Sic tandem ventum eſt ad hoc problema Geometricum*: Datis tribus lineis, in uno Ellipſeos foco coeuntibus, tam longitudine quàm poſitione, invenire longitudinem tranſverſæ diametri, cum diſtantiâ focorum: *Cujus reſolutio extenditur etiam ad reliquos planetas, ſi, poſt Theoriam motûs Terræ cognitam, ſcrutemur* (*ſecundum methodum propoſitam à Reverendiſſ. Epiſcopo* Sariſburienſi *in* Aſtronomia *ejus* Geometricâ lib. 2. part. 2. cap. 5.) *tres diſtantias planetæ alicujus à Sole in poſitionibus ſuis. Quoniam verò Rev. Epiſcopus ſupponit planetam ita ferri in orbe ſuo, ut æqualibus temporibus æquales angulos ad focum alterum Ellipſeos abſolvat, & ei calculum ſuum ſuperſtruit, non incongruum videtur, oſtendere, quomodo id ipſum fieri poſſit abſque iſta ſuppoſitione, quam obſervatio nos rejiciendam monet.*

Tab.I. Fig.3. *Sit* S, *Sol*; ALBK, *orbis Terræ*; P, *Planeta, vel Punctum in plano Eclipticæ, ubi perpendicularis, à planeta demiſſa, incidit*; AB *linea Apſidum orbis Terræ: Obſerventur primò Planetæ, in* P, *longitudo & latitudo, ſimulque Solis Longitudo à Terra in* K; *& poſt periodum ejuſdem planetæ, Terra exiſtente in* L, *obſerventur denuo poſitiones Planetæ Solisque, ut prius: Jam ex obſervatis longitudinibus Solis & Aphelii Terræ, anguli* ASK, ASL *dantur, & conſequenter latera* SK, SL: (*Nam ſi angulus Anomaliæ coæquatæ ſit* acutus, *proportio eſt, ut differentia diſtantiæ mediæ & Co-ſinus anguli in Eccentricitatem ducti, ad diſtantiam Apheliam, ita Perihelia diſtantia, ad diſtantiam Planetæ à Sole in datâ Anomaliâ: quòd ſi angulus fuerit* obtuſus, *primus terminus proporti-*

onis

onis eſt ſumma duarum partium, quarum in priori analogia fuit differentia : Hujus Theorematis demonſtrationem neminem Analytices modicè peritum latere poſſe arbitror, & idcirco ei ſuperſedeo :) Jam in Triangulo KSL *dantur latera* KS, LS, *& angulus* KSL, *quæruntur Latus* KL, *& anguli* SKL, SLK : *Deinde in Triangulo* KLP, *dantur* KL, KLP, *differentia obſervatarum Longitudinum planetæ, &* PKL *differentia angulorum* SKL *ultimò inventi, &* SKP *Elongationis Planetæ à Sole in prima obſervatione, quæritur* LP : *Tum in Triangulo* LSP, *latera* LS, LP, *& angulus* PLS *elongatio Planetæ à Sole in ſecunda obſervatione, dantur; latus* SP *& angulus* LSP *requiruntur, quibus inventis, ut* SP *ad* LP, *ita Tangens Latitudinis obſervatæ ex* L, *ad Tangentem Inclinationis ſive Latitudinis ad Solem; & ut Co-ſinus Inclinationis ad Radium, ita* SP *curtata diſtantia, ad veram diſtantiam planetæ à Sole : Sic tandem invenimus poſitionem & longitudinem deſideratam. Jam reſtat ut oſtendam, quomodo ex datis tribus diſtantiis à Sole cum angulis interceptis, invenienda ſit media diſtantia cum Eccentricitate Ellipſeos.*

Tab. I. Fig. 4.

Sit S *Sol, &* SA, SB, SC *tres diſtantiæ in debita poſitione, ductiſque* AB, BC, *ſit* AB *diſtantia focorum Hyperbolæ, &* $SA-SB=EH$ *tranſverſa diameter ; quibus poſitis, deſcribatur linea iſta Hyperbolica, cujus focus interior eſt punctum* A, *extremitas lineæ longioris* SA : *Pari modo ſint* B, C, *foci alterius Hyperbolæ, cujus diameter* $SB-SC=KL$; *ex quibus deſcribatur linea Hyperbolica focum habens interiorem in puncto* B : *Dico has duas Hyperbolas ſic deſcriptas ſeſe interſecare in puncto* F, *qui eſt alter Ellipſeos quæſitæ focus, ductâque lineâ* FA, FB, *vel* FC, $SA+FA$, $SB+FB$ *vel* $SC+FC$ *æquabitur tranſverſæ diametro; &* SF *eſt diſtantia focorum : quibus poſitis deſcriptio Ellipſeos facillima eſt. Cùm verò hujus conſtructionis ratio non omnibus ita facile percipiatur, non abs re erit, illuſtrationem ejus aliquam afferre ; Ideò dico, quòd ex notiſſima Ellipſeos proprietate* $SB+FE=SA+FA$, *& tranſpoſitis æquationis partibus* $FB-FA=SA-SB$, *ita ut etiamſi* FB *&* FA *nos lateant, earum tamen differentia æqualis ſit* $SA-SB$, *hoc eſt,* EH, *cúmque ſit ex natura Hyperbolæ, ut habeat quaſvis duas lineas à ſuis focis ad quodvis punctum in ſua curva conſtanter differentes quantitate tranſverſæ diametri; conſtat, punctum* F *eſſe alicubi in curva Hyperbolæ, cujus diameter tranſverſa æquatur* $SA-SB$, *& Foci* A, B : *Pari modo demonſtrari poteſt punctum* F *eſſe in Hyperbola cujus diameter eſt* $SB-SC$, *& foci* B, C. *Ergo neceſſe eſt, ut ſit in interſectione duarum iſtarum Hyperbolarum, quæ, cùm ſeſe interſecent in unico ſolum puncto, clarè oſtendunt ubi ſit Focus alter Ellipſeos quæſitæ.*

Jam ut id ipſum Analyticè expediatur, puta factum, ſitque $FF=a$, $SA-SB=FB-FA=b$, $AB=c$, $SB-SC=FC-FB=d$, $BC=f$, *ſitque Sinus anguli* $ABC=S$, *Co-ſinus ejuſdem*$=s$.

Tum

Tum ut c *ad* b, *ita* 2a-b *ad* $\frac{2ab-bb}{c}$ *&* $\frac{2af-bb+cc}{2c}$ =BD *per* 36. 3 Eucl. *& ut* f *ad* d, *ita* 2a+d *ad* $\frac{2ad+dd}{f}$ *&* $\frac{ff-2ad-dd}{2f}$ =BG *per eandem*, *& ut minuatur labor calculi ſit* $\frac{cc-bb}{2c}$ =g *&* $\frac{b}{c}$ =h, *ſimiliter ſit* $\frac{ff-dd}{2f}$ =k Per 12 & 13 lib.2. Eclid. *&* $\frac{d}{f}$ =l, *tunc* DB=g+ha, *&* BG=k--la; *& quoniam in omni* *Triangulo* $\left\{\begin{matrix}\textit{obtuſangulo}\\ \textit{acutangulo}\end{matrix}\right\}$ *quadratum baſis æquatur* $\left\{\begin{matrix}\textit{ſummæ}\\ \textit{differentiæ}\end{matrix}\right.$ *ſummæ quadratorum laterum*, *& dupli rectanguli laterum in Coſinum anguli comprehenſi ducti*, *erit* gg+2gha+hhaa+kk-2kla+llaa +2gks-2glsa+2khsa-2hlsaa *æqualis quadrato* DG: *Sed* DG *æqualis eſt ſinui Anguli* DFG *vel* DBG *in* a, *id eſt* FB *ducto*, (*eſt enim quadrilaterum* FBDG *circulo, cujus diameter eſt* FB, *inſcriptum*;) *ideo* SSaa=gg+2gha+hhaa+kk-2kla+llaa+2gks-2glsa+2khsa-2hlsaa; *quæ æquatio facile reſolvitur*, *cùm non excedat quadraticam affectam*, *ſemperque componitur ex iſtis Quadratis & Rectangulis*; *ſigna tamen* + *&* -- *ob diverſam trium linearum conſtitutionem multâ cautione ſunt rectangulis adhibenda. Noſtram æquationem aptavimus figuræ* IV, *ſed in alio quovis caſu non erit difficile attendenti*, *ex iis quæ ſuperius tradidimus*, *ſimilem conſtituere. Sic tandem abſolvi propoſitum meum*, *& oſtendi*, *quomodo ex tribus locis Heliocentricis Planetæ*, *& diſtantiis à Sole obſervatis*, *deſcribi poſſit Orbita iſtius Planetæ*; *quod non niſi quinque talibus obſervationibus hactenus effectum vidimus.*

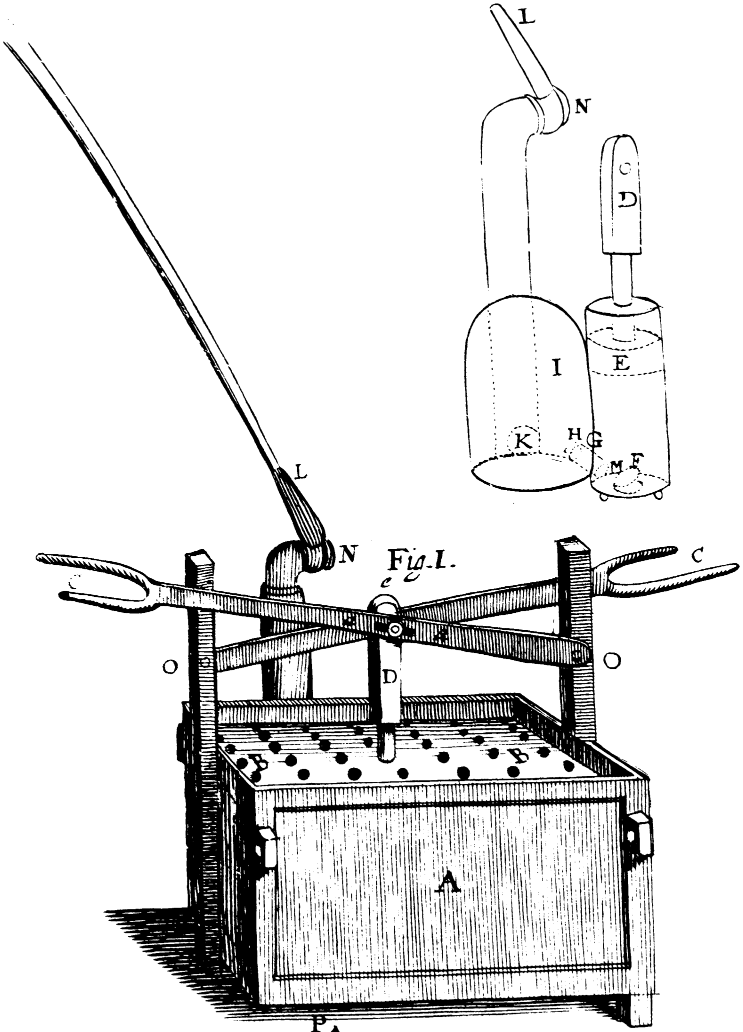

Fig.I.

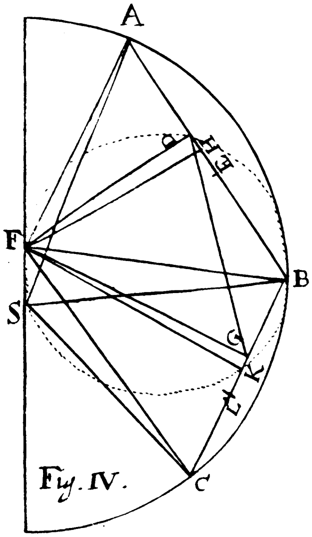

Fig.IV.

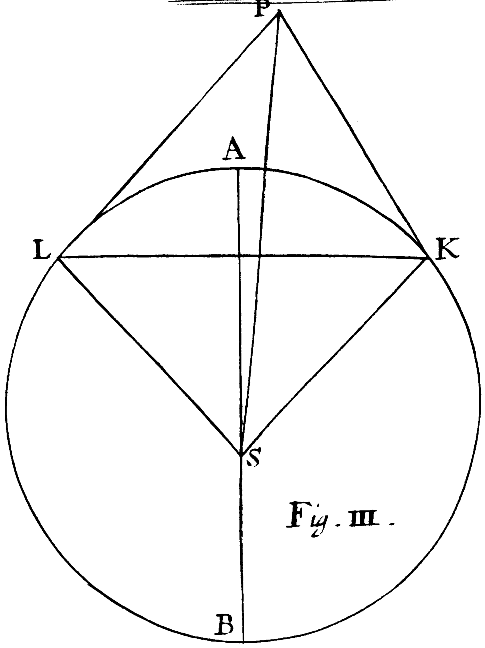

Fig.III.

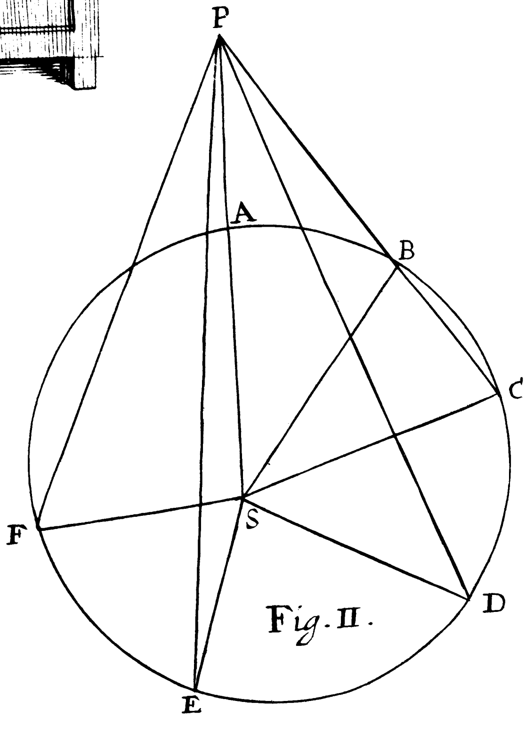

Fig.II.